

STUDIES ON NORTH AMERICAN CARBONIFEROUS
INSECTS. 2. THE GENUS *BRODIOPTERA*, FROM THE
MARITIME PROVINCES, CANADA*

BY F. M. CARPENTER
Harvard University

Although few in number, the insects which have been found in the Upper Carboniferous strata of the Maritime Provinces of Canada are of exceptional interest. They occur in rocks which are well down in the Westphalian stage (Zone A) and are therefore only a little younger than the oldest insects known (Namurian). In 1957, Dr. M. J. Copeland of the Canada Department of Mines and Technical Surveys published an account of the arthropod fauna of the Upper Carboniferous rocks of these provinces and included descriptions of two species of the genus *Brodioptera*, which he placed in the Order Megaseoptera. Since Dr. Copeland's descriptions and illustrations are inadequate for our present needs of interpreting the relationships of these insects, I have found it necessary to make a study of this material. I am indebted to Dr. Copeland for arranging to have the type specimens loaned to me for this purpose.

One of the species which Copeland placed in *Brodioptera* is a member of the Order Megaseoptera, as thought by him, although its affinities within the group are different from those which he assumed; the other species described in *Brodioptera* is not a megaseopteron at all but very clearly a member of the Order Palaeodictyoptera.

Order Megaseoptera
Family **Brodiopteridae**, new family

Anterior margin of wing very nearly straight proximally; hind margin apparently nearly straight or only slightly curved; the wing was almost certainly not petiolate, although the absence of the basal part of the hind margin permits the possibility of a slight narrowing in that region. Sc terminating on C, R1 straight at the base of the wing, not arched proximally; MA free from Rs, and Cu and CuA free from MP; one anal vein. Cross veins few and widely scattered.

This family is probably more closely related to the Sphecopteridae and the Corydaloididae than to any other known families of the order.

*This research has been aided by a grant (NSF-G14099) from the National Science Foundation. The previous part of this series was published in *Psyche*, 67: 98-110, 1961.

It is far removed from the family Brodiidae, within which it was placed by Copeland; it lacks the extreme petiolation characteristic of the Brodiidae, and more significantly, lacks the strikingly serrate costal margin, which is the outstanding feature of the brodiids. In the sphecopterids the subcosta terminates on the radius, the radial sector (at least in the fore wing) is anastomosed for a short distance with MA, and the cross veins are very regularly arranged, forming definite rows. In the corydaloidids the subcosta terminates in the costal area without definitely ending on either the costa or R1; and there is a brief anastomosis of MA with Rs and of CuA with M.

Brodioptera Copeland, 1957

Brodioptera Copeland 1957, Geological Survey of Canada, Mem. 286:53.

Wing venation: Sc terminating about two-thirds of the wing length from the base; Rs with several branches, MA, MP (apparently), CuA and CuP unbranched.

Type species: *Brodioptera cumberlandensis* Copeland.

Brodioptera cumberlandensis Copeland, 1957

Figure 1

Brodioptera cumberlandensis Copeland, 1957, Geol. Surv. Canada, Mem. 286:53.

Length of wing, 17 mm; maximum width, 4.5 mm.¹ Apex of wing rounded; Rs branched to form R2a, R2b, R3, R4+5; MA arising slightly distad of the origin of Rs; CuA arising much nearer the base of the wing. The arrangement of cross veins is shown in figure 1.

Type: no. 10390 (obverse and reverse), Geological Survey of Canada. This consists of a fairly well-preserved wing, lacking only the very base and a few small areas near the middle of the wing. Whether the wing is a fore or hind wing cannot be determined. The convexities and concavities of the veins are clearly indicated. The specimen was collected by Henry M. Ami, in 1899, in deposits at West Bay, Plarrsboro, Cumberland County, Nova Scotia. The deposit is stated by Dr. Copeland to belong to the Riversdale group and more specifically by Ami as probably of Joggins coalfield, of the Coal Measures.

This specimen is generalized so far as the absence of fusion of main veins is concerned but it is highly specialized in the reduction of branches on all veins accepting Rs, in the close proximity of Sc and R1 to the costal margin, and in the small number of cross veins. It is surprising to find a megascopter as specialized as this in the Rivers-

¹The dimensions are incorrectly indicated on p. 101 of Copeland's paper (1957).

dale group of strata, which is regarded as being about equivalent to Westphalian Zone A, just above the Namurian stage, in which the oldest insects (unquestionable) have been found.

Palaeodictyoptera

Family Dictyoneuridae Handlirsch²

I am placing the species described by Copeland as *Brodioptera amii*³ in the family Dictyoneuridae, although I have doubts about its actually belonging within the limits of the family. The most distinctive characteristic of the Dictyoneuridae is the presence of an archedictyon over the wing surface. Unfortunately the specimen of *amii* shows no signs of either cross veins or an archedictyon, probably because of the coarse nature of the matrix in which the fossil is preserved. On the assump-

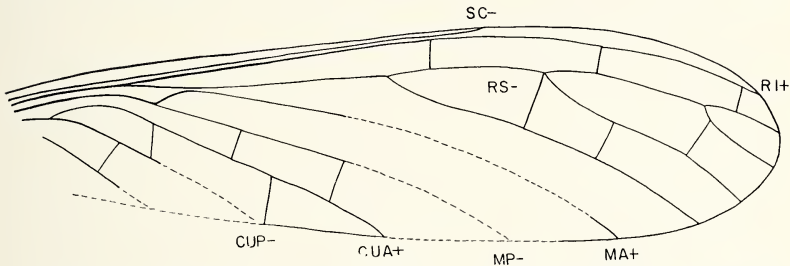


Figure 1. *Brodioptera cumberlandensis* Copeland. Original drawing, based on holotype. C, costa; Sc, subcosta; Rl, radius; Rs, radial sector; MA, anterior media; MP, posterior media; CUA, anterior cubitus; CUP, posterior cubitus; 1A, first anal vein.

tions that true cross veins probably would show, if they were present, I am tentatively assigning the species to the Dictyoneuridae. Other characteristics of the family include the subcosta ending on the costal margin, well beyond the middle of the wing; Rl ending nearly at the apex, Rs with at least three branches; MA unbranched and arising as a distinct anterior branch of the media, CuA typically unbranched (though occasionally with a distal fork) and CuP with several branches. All of these features occur in the specimen of *amii*. The one characteristic of *amii* that has not previously been noted in the Dictyoneuridae is the presence of a definite cross vein joining the anterior media with the radial sector; such a vein, present in *amii*,

²The name Stenodictyopteridae Brongniart used by some authors (e.g., Pruvost, 1919; Laurentiaux, 1953) for this family is invalid, since it is not based on a generic name.

³The name *amiae* was used by Dr. Copeland in error. He has informed me (*in litt.*) that the species was named for Dr. Henry M. Ami, the collector of the fossil, and that the name should accordingly have been *amii* instead of *amiae*.

may have been formed by an alignment of the sides of several of the cellules comprising the archedictyon. The wing on which *amii* is based is quite clearly a hind wing and although this is broader than the hind wings of any known dictyoneurids, the hind wings in several genera are markedly broader in the anal region than the fore wings. The greater differentiation in *amii* seems to me insufficient to eliminate it from the family on this basis alone. However, a distinct genus seems to be necessary for the fossil, since the genus into which it was placed by Copeland is a megasecopteran.

Schedoneura, new genus

Main veins of the wing with the general characteristics of the dictyoneurids: Sc and Rs extending almost to the apex, Rs arising just before the middle of the wing, with four branches; MA un-

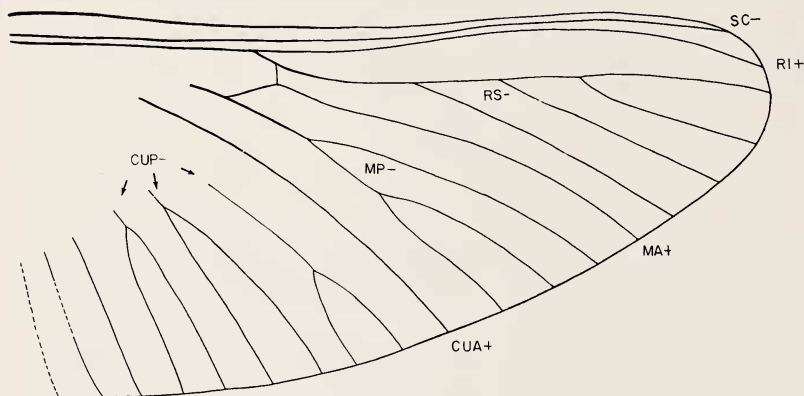


Figure 2. *Schedoneura amii* (Copeland). Original drawing, based on holotype. Lettering as in figure 1.

branched, joined to the base of Rs by a distinct cross vein; CuA unbranched; CuP very well developed, with six terminal branches; several anal veins.

Type species: *Brodioptera amii* Copeland

Schedoneura amii (Copeland)

Figure 2

Brodioptera amii Copeland, 1957, Geol. Surv. Canada, Mem. 286: 54, pl. 18, fig. 4-6.

Hind wing: length, 13.5 mm; maximum width, 6.5 mm.⁴ Branches of Rs about equally spaced, the basal branches arising pectinately, the

⁴The dimensions are incorrectly indicated on p. 101 of Copeland's paper (1957).

terminal ones forming a dichotomous fork. MA arises slightly basad of the level of the origin of Rs; MP with three branches; the six terminal branches of CuP are formed by bifurcation of three main branches, although their origin is not preserved in the fossil. The venational details are shown in text figure 2.

Type no. 10392 (obverse and reverse), Geological Survey of Canada. The specimen was collected by Henry M. Ami, in 1899, specifically at Howard's Mills, River Wallace, Cumberland County, Nova Scotia. This is placed by Dr. Copeland in the Riversdale group. The fossil consists of a moderately well-preserved wing, lacking only the base of the anal area and a part extending out towards the center of the wing from the base. The convexities and concavities of the veins are clearly shown but there are no indications of cross veins or of an archedictyon. The distal part of this wing is preserved on the counterpart; the rest of the wing is preserved in one piece.

As indicated above under discussion of the family relationships, the affinities of this fossil are not at all clear. That it is a palaeodictyopteron is obvious; however, the absence of an archedictyon or a cross venational system leaves us somewhat uncertain about its relationships. The main venational pattern, as indicated above, conforms to that of the Dictyoneuridae.